(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date 8 January 2004 (08.01.2004)

(10) International Publication Number WO 2004/003108 A1

(51) International Patent Classification7:

C09K 19/34

(21) International Application Number:

PCT/GB2003/002777

(22) International Filing Date:

30 June 2003 (30.06.2003)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

0215153.8

1 July 2002 (01.07.2002)

- (71) Applicant (for all designated States except US): THE UNIVERSITY OF HULL [GB/GB]; Cottingham Road, Hull, North Humberside HU6 7RX (GB).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): KELLY, Stephen, Malcolm [GB/GB]; 25 Richmond Way, Beverley, East Yorkshire HU17 8XA (GB). O'NEILL, Mary [GB/GB]; 33 Wellesley Avenue, Berverly Road, Hull HU17 8XA (GB).
- (74) Agent: ATKINSON, Peter, Birch; Marks & Clerk, 83-85 Mosley Street, Manchester M2 3LG (GB).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

of inventorship (Rule 4.17(iv)) for US only

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: LUMINESCENT COMPOSITIONS

(57) Abstract: A composition capable of emitting circularly polarised light comprises a medium including a chiral, helical liquid crystalline phase with a substantially fixed, temperature independent helical pitch. The liquid crystalline phase is comprised of calamatic liquid crystal molecules having a luminescent moiety and the composition is such that excitation of the luminescent moiety causes the medium to emit light in the bandwidth of selective reflection of the liquid crystalline phase. To achieve the substantially temperature independent helical pitch, the chiral helical liquid crystalline phase may be in the form of a glass or a polymerised network. The composition may be used to produce a light emitting device, e.g. and OLED.





INTERNATIONAL SEARCH REPORT

Internatic pplication No PCT/GB 03/02777

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 C09K19/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols) $\begin{tabular}{ll} IPC & 7 & C09K \end{tabular}$

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUM	ENTS CONSIDERED TO BE RELEVANT	
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to daim No.
Α	US 6 337 150 B1 (KWON ET AL) 8 January 2002 (2002-01-08) claims	1-34
A	US 5 876 864 A (KIM CHUNG YUP ET AL) 2 March 1999 (1999-03-02) claims	1-34
A	US 5 807 974 A (KIM CHUNG YUP ET AL) 15 September 1998 (1998-09-15) the whole document	1-34
А	WO 97 07654 A (PHILIPS ELECTRONICS NV; PHILIPS NORDEN AB (SE)) 27 February 1997 (1997-02-27) cited in the application the whole document	1-34
	-/	

Further documents are listed in the continuation of box C.	Y Patent family members are listed in annex.
Special categories of cited documents: 'A' document defining the general state of the art which is not considered to be of particular relavance 'E' earlier document but published on or after the international filing date 'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) 'O' document referring to an oral disclosure, use, exhibition or other means 'P' document published prior to the international filing date but later than the priority date claimed	 *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family
Date of the actual completion of the international search 20 October 2003	Date of mailing of the international search report 05/11/2003
Name and mailing address of the ISA European Patent Office, P.B. 6818 Patentiaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Serbetsoglou, A



INTERNATIONAL SEARCH REPORT

iternati spr

Internet Application No
PCT/GB 03/02777

	PC1/GB 03/02///
etion) DOCUMENTS CONSIDERED TO BE RELEVANT	
Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
US 2003/119936 A1 (O'NEILL ET AL) 26 June 2003 (2003-06-26) claims	1-34
VOIGT M ET AL: "CIRCULARLY POLARIZED EMISSION FROM A NARROW BANDWIDTH DYE DOPED INTO A CHIRAL NEMATIC LIQUID CRYSTAL" LIQUID CRYSTALS, TAYLOR AND FRANCIS LTD, LONDON, GB, vol. 29, no. 5, May 2002 (2002-05), pages 653-656, XP001102371 ISSN: 0267-8292 the whole document	1-8
MORITA M ET AL: "Luminescence and circularly polarized luminescence of excited-state chiral structures in one-dimensional PIC-J dye aggregates" MICROELECTRONIC ENGINEERING, ELSEVIER PUBLISHERS BV., AMSTERDAM, NL, vol. 51-52, May 2000 (2000-05), pages 605-611, XP004199427 ISSN: 0167-9317 the whole document	1-8
DATABASE INSPEC 'Online! INSTITUTE OF ELECTRICAL ENGINEERS, STEVENAGE, GB; BIN LIU ET AL: "Application of alternating fluorene and thiophene copolymers in polymer light-emitting diodes" Database accession no. 7424597 XP002258305 abstract & SYNTHETIC METALS, 10 JULY 2002, ELSEVIER, SWITZERLAND, vol. 129, no. 2, pages 129-134, ISSN: 0379-6779	1,16-22
	US 2003/119936 A1 (O'NEILL ET AL) 26 June 2003 (2003-06-26) claims VOIGT M ET AL: "CIRCULARLY POLARIZED EMISSION FROM A NARROW BANDWIDTH DYE DOPED INTO A CHIRAL NEMATIC LIQUID CRYSTAL" LIQUID CRYSTALS, TAYLOR AND FRANCIS LTD, LONDON, GB, vol. 29, no. 5, May 2002 (2002-05), pages 653-656, XP001102371 ISSN: 0267-8292 the whole document MORITA M ET AL: "Luminescence and circularly polarized luminescence of excited-state chiral structures in one-dimensional PIC-J dye aggregates" MICROELECTRONIC ENGINEERING, ELSEVIER PUBLISHERS BV., AMSTERDAM, NL, vol. 51-52, May 2000 (2000-05), pages 605-611, XP004199427 ISSN: 0167-9317 the whole document DATABASE INSPEC 'Online! INSTITUTE OF ELECTRICAL ENGINEERS, STEVENAGE, GB; BIN LIU ET AL: "Application of alternating fluorene and thiophene copolymers in polymer light-emitting diodes" Database accession no. 7424597 XP002258305 abstract & SYNTHETIC METALS, 10 JULY 2002, ELSEVIER, SWITZERLAND, vol. 129, no. 2, pages 129-134,

Form PCT/ISA/210 (continuation of second sheet) (July 1992)







Internati (pplication No PCT/GB 03/02777

0.10		PC1/6B 03/02///
C.(Continu	ation) DOCUMENTS CONSIDERED TO BE RELEVANT Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	oration or document, with mulcation, where appropriate, or the relevant passages	Helevant to Claim No.
A	DATABASE INSPEC 'Online! INSTITUTE OF ELECTRICAL ENGINEERS, STEVENAGE, GB; CHARAS A ET AL: "Synthesis and optical properties of poly(fluorene)-based alternating copolymers" Database accession no. 6956735 XP002258307 abstract & EUROPEAN MATERIALS RESEARCH SOCIETY 2000 SPRING MEETING, SYMPOSIUM I: ORGANIC ELECTRONICS; FROM LIGHT EMITTING DIODES TO INTEGRATED CIRCUITS, STRASBOURG, FRANCE, 30 MAY-2 JUNE 2000, vol. 122, no. 1, pages 23-25, Synthetic Metals, 1 May 2001, Elsevier, Switzerland ISSN: 0379-6779	1,16-22
P,A	CHARAS A ET AL: "Synthesis and luminescence properties of three novel polyfluorene copolymers" POLYMER, ELSEVIER SCIENCE PUBLISHERS B.V, GB, vol. 44, no. 6, March 2003 (2003-03), pages 1843-1850, XP004410272 ISSN: 0032-3861 page 1844	1,16-22





Internat Application No PCT/GB 03/02777

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 6337150	B1	08-01-2002	KR JP	2000032065 A 2000143778 A	05-06-2000 26-05-2000
US 5876864	A	02-03-1999	KR	176336 B1	01-04-1999
US 5807974	A	15-09-1998	KR GB JP JP	176331 B1 2313127 A ,B 3121282 B2 10036487 A	01-04-1999 19-11-1997 25-12-2000 10-02-1998
WO 9707654	A	27-02-1997	DE DE EP WO JP US	69613093 D1 69613093 T2 0787419 A1 9707654 A1 10508979 T 5748271 A	05-07-2001 22-11-2001 06-08-1997 27-02-1997 02-09-1998 05-05-1998
US 2003119936	A1	26-06-2003	US	2003018097 A1	23-01-2003